Numerical Analysis (CS 450)

Worksheet 22

Objectives: (1) Derive Gauss-Newton and Levenberg-Marquardt from Newton **(2)** Understand how to deal with equality and inequality constraints

Problem 1: Gauss-Newton

(a) Suppose you want to fit the function $f(t_i, \boldsymbol{x}) = x_0 e^{x_1 t}$ to some data, say (t_i, y_i) for $i = 1, \ldots, 4$. What function do you want to minimize?

(b) What is the gradient of this function?

(c) What is the difference between a Newton method for this problem and a Gauss-Newton method for this problem?

Problem 2: Constrained optimization

(a) What is the Lagrangian function for the following problem?

$$\min_{(x,y)} x^2 + y^2$$
$$\text{subject to } x + y - 1 = 0$$

(b) What system of equations would you consider to solve this constrained optimization problem?

(c) Are the solutions of this system guaranteed to be local minima of the constrained optimization problem?